Cyclic Stretch is a Potent Cue for Animal Cells

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Throughout the organism, all tissue cells experience mechanical strain, e.g. due to the pulsating blood flow. Cells recognize, process, and act upon this signal. To study this mechanoresponse we applied well-defined mechanical strain cyclically to cultivated cells [1]. Cellular mechanoresponses were quantified via reorientation of cytoskeletal fibers. In cultivated endothelial cells we compared responses of actin, microtubules, and vimentin [2, 3] using a correlation-based algorithm that enabled quantification of cytoskeletal order. We observed distinctly different ordering dynamics and amplitudes [3].
Even though the rigid skull protects the brain, it experiences intense mechanical deformations. Therefore we studied mechanoresponses of primary neurons from cortices of rat embryos. We observed a pronounced reorientation of neuronal dendrites upon cyclic strain and found a surprising mechanical resilience of these cells that survived even several days of uniaxial, cyclic stretching at an amplitude of 28% and a frequency of 300 mHz [4].

[1] U. Faust et al., PLOS ONE 6, e28963 (2011).
[2] A. Zielinski et al., Cytoskeleton 75, 385 (2018)
[3] R. Springer et al., PLOS ONE 14, e0210570 (2019)
[4] J.-A. Abraham et al., Langmuir 35, 7423 (2019)